

## **ABSTRACT OF THE DISCLOSURE**

A method of depositing a film of a metal chalcogenide. The first of  
5 these methods includes the steps of: contacting at least one metal  
chalcogenide, a hydrazine compound and optionally, an elemental  
chalcogen, to produce a solution of a hydrazinium-based precursor of the  
metal chalcogenide; applying the solution of the hydrazinium-based  
precursor of the metal chalcogenide onto a substrate to produce a film of  
10 the precursor; and thereafter annealing the film of the precursor to remove  
excess hydrazine and hydrazinium chalcogenide salts to produce a metal  
chalcogenide film on the substrate. The second of these methods  
includes the steps of: contacting: at least one metal chalcogenide and a  
salt of an amine compound to produce an ammonium-based precursor of  
15 the metal chalcogenide; contacting the ammonium-based precursor of the  
metal chalcogenide and a hydrazine compound, and optionally, an  
elemental chalcogen, to produce a solution of a hydrazinium-based  
precursor of the metal chalcogenide in the hydrazine compound; applying  
the solution of the hydrazinium-based precursor onto a substrate to  
20 produce a film; and thereafter, annealing to produce a metal chalcogenide  
film. Also provided is a thin-film field-effect transistor device using the  
metal chalcogenides as the channel layer.